

Experimenting with Group Work in On-Line Synchronous Math Recitations

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Georgia's Race To The Top

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Course Structure

Math 1502

- is a large multi-section course offered at Georgia Tech
- focuses on linear algebra
- lectures held MWF, recitations held Tu/Th
- is taught simultaneously to undergraduate and high school students
- the high school students
 - receive “equivalent credit” when completing this course
 - typically perform very well, relative to the undergraduate students

Interaction

- the high school students connect to lectures & recitations through **video** conferencing
- however
 - some high schools can't/won't pay for video conferencing system
 - little interaction between high school students and TAs during recitations
- we wanted a cheaper and more interactive method of delivering recitations

Experiment: Web Conferencing

- One section with 16 students, who connect to recitations with a **web** conferencing system, “Wimba Classroom”, which
 - is supported by Blackboard,
 - doesn’t cost students/high schools anything to use.
- All 16 students were loaned Wacom Bamboo tablets.

Group Work Example

five students that attend recitations in same physical room

Example 1 Find i) a nonzero vector in Nul A, and ii) a vector in Col A.

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 7 \\ -5 & -1 & 0 \\ 2 & 7 & 11 \\ 3 & 3 & 4 \end{bmatrix} \sim [\vec{A} \ 0] \sim \begin{bmatrix} 1 & 2 & 3 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

$\begin{bmatrix} 1 & 2 & 3 & 0 \\ 0 & -3 & -5 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$

z is free z = 1

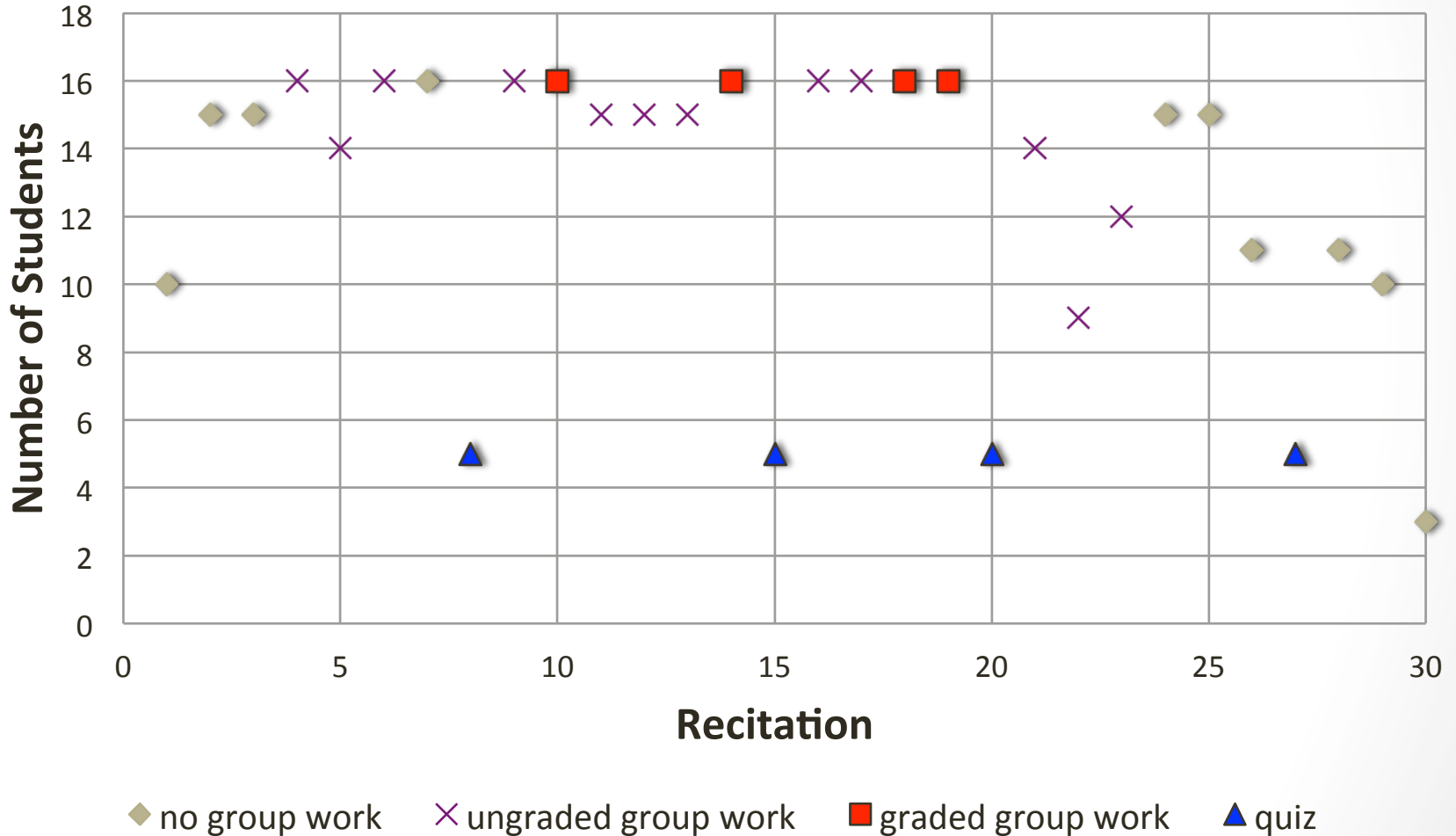
ii) Because Col A is the linear combinations of the columns of A, one vector in col A should be

$\begin{bmatrix} 6 \\ 16 \\ -6 \\ 20 \\ 10 \end{bmatrix}$

i) $\begin{bmatrix} 1/3 \\ -5/3 \\ 1 \end{bmatrix}$

Green: [student name] Orange: [student name]
 blue = [student name] purple is [student name]
 red = [student name]

of Students Logged Into Wimba Per Recitation



Quantitative Evaluation

- pre/post online surveys
- pre-survey incorporated questions from an online survey to explore students goals in the context of group work
- but: response rate was low (38%)
 - I don't meet students face-to-face
 - consent from parents and students required
- qualitative comments were more helpful

Qualitative Data

What were the strengths of having collaboration activities for this course?

- “allowed me to further understand the subject material and helped me learn to work with other people”
- “if you think of mathematics as a language, it gave you the chance to collaboratively speak the language”

What were the weaknesses of having collaboration activities for this course?

- “Some groups finished within a few minutes while others took much longer”
- “It also felt like a few people dominated the entire discussion or problem.”

Conclusions

- similar approach currently being used in a multivariable calculus course with
 - same students
 - same instructor
 - same technologies
- changes:
 - microphones?
 - different evaluation method: focus groups
 - allow students to have input into the learning objectives of recitations

Questions?

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Ungraded Group Work

five students from 3 different high schools

Example 1 Find i) a nonzero vector in Nul A, and ii) a vector in Col A.

really grey

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 7 \\ -5 & -1 & 0 \\ 2 & 7 & 11 \\ 3 & 3 & 4 \end{bmatrix}$$

Handwritten work includes:

- Row reduction steps: $4a_i = 0 - 1 - 5 + 0 = 0$, $-3 - 8 = 0$, $00 - 5 + 8 = 0$
- Column 1 identified: $\text{Col } A = \begin{bmatrix} 1 \\ 4 \\ -5 \\ 2 \\ 3 \end{bmatrix}$
- Row echelon form: $\begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$
- System of equations: $x_2 = 5x_3$, $x_1 = -3x_2 - 2x_3$
- Null space vector: $\text{Nul } A = \begin{bmatrix} -13 \\ 5 \\ 1 \end{bmatrix}$

Two grey boxes labeled "student initials" are present on the right side of the work.

(Evolving) Group Work Rules

1. Group size is 2 to 6 students
2. Someone is in your group when they write their initials on board
3. Students can create breakout rooms
4. Colors:
 - a) Every student uses a different color
 - b) Every student signs initials (or name) on board in their color
5. *Everyone in each group gets same grade*